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Title: The Wide Power and Applicability of Robotics

Author(s): Grow, David Isaac

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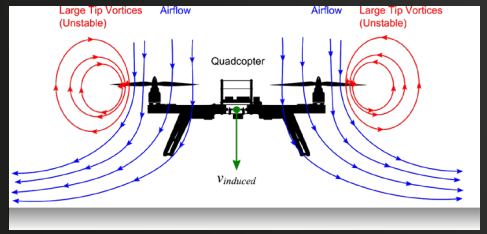

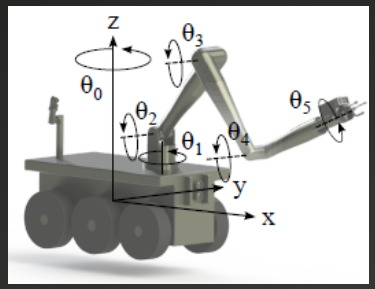

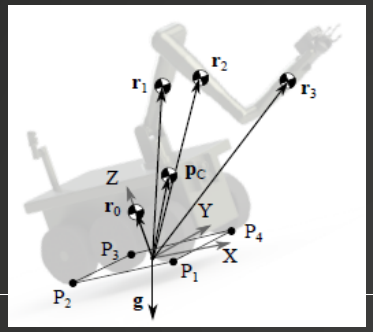

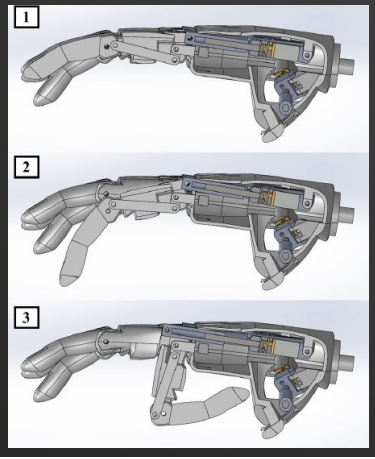

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Delivering science and technology
to protect our nation
and promote world stability

The Wide Power and Applicability of Robotics

How can you recognize the hidden robots all around you?

What is the ideal human-robot relationship?

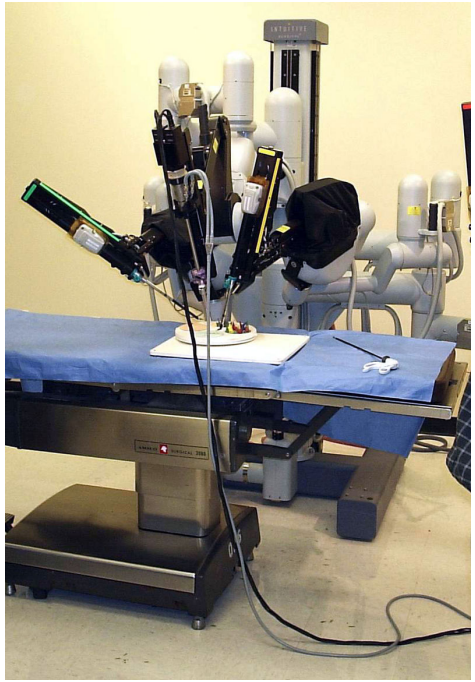
How can robots protect people from dangerous situations?

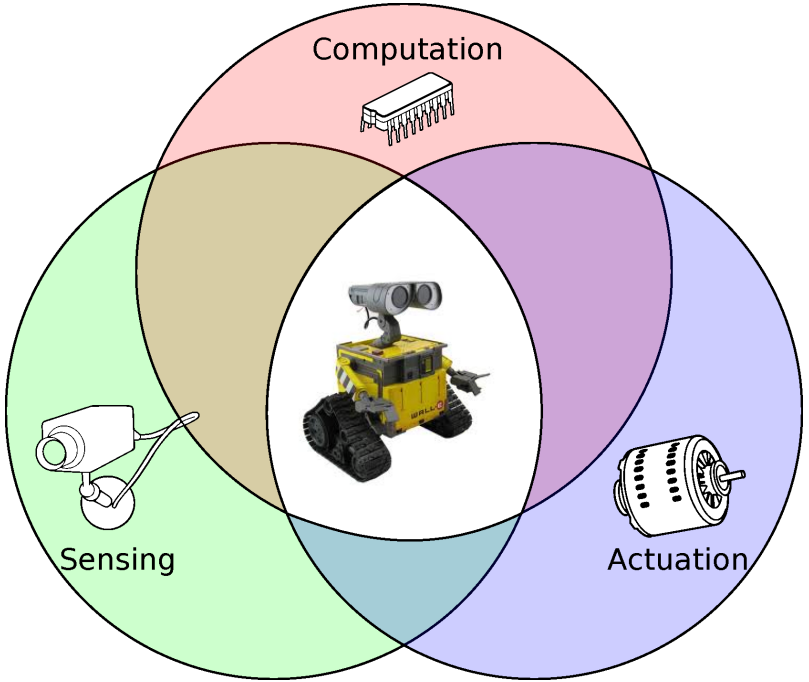
Dr. David Grow

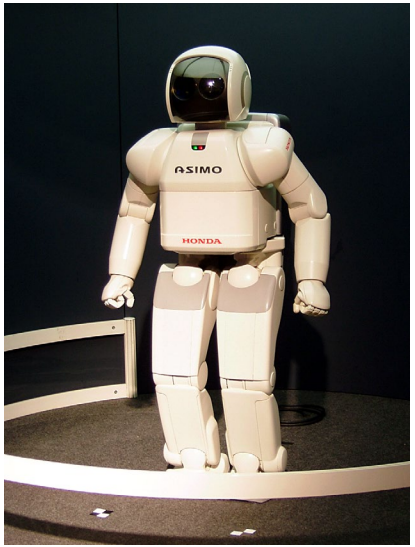
11/16/20

NNSA National Nuclear Security Administration

Managed by Triad National Security, LLC for the U.S. Department of Energy's NNSA




Computation
Sensing
Actuation


ASIMO
HONDA

Robots as Tools for Rehabilitation and Assistance

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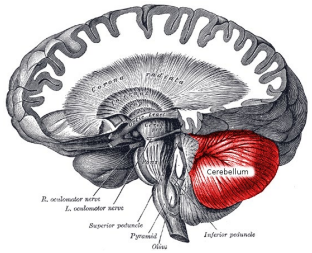
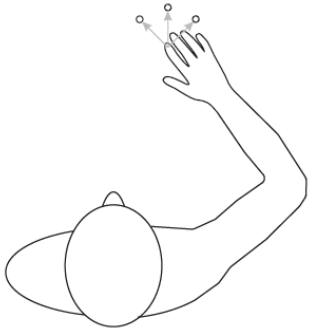
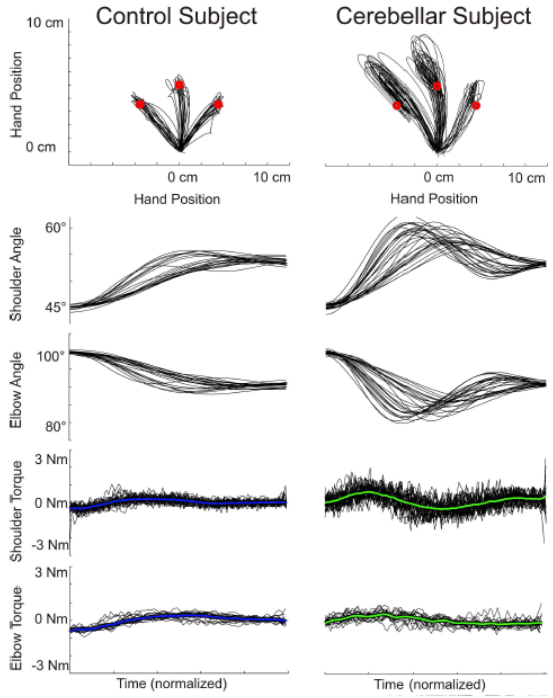
basic neuroscience

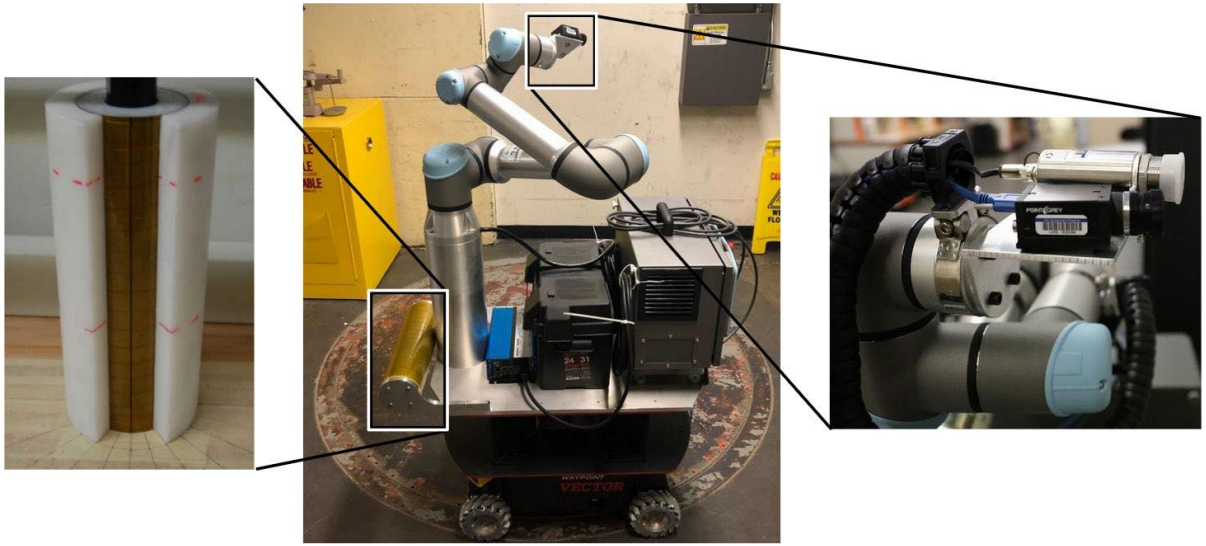
model-based rehabilitation

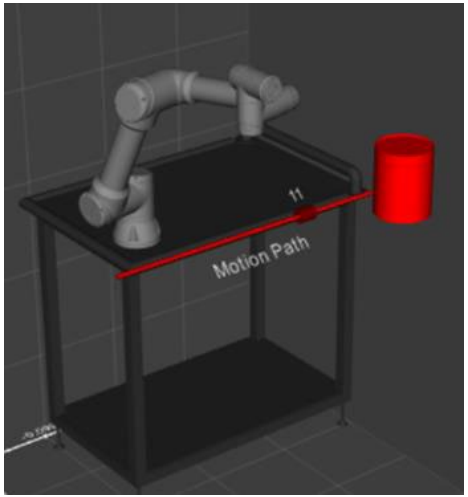


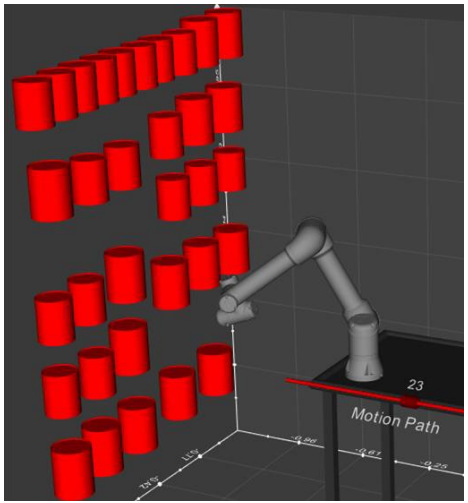




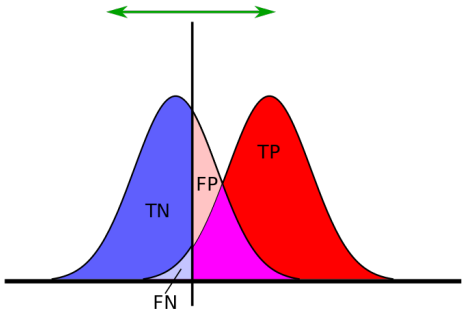

TURN TO CLOSE BEFORE LIFTING
OPEN
CLOSED


VECTOR

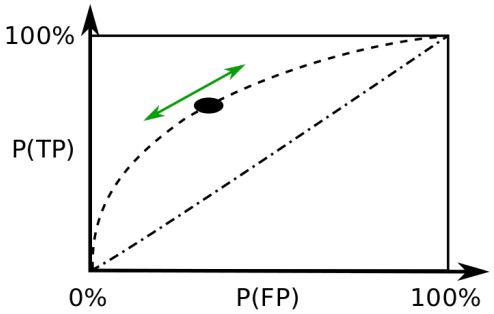

11
Motion Path

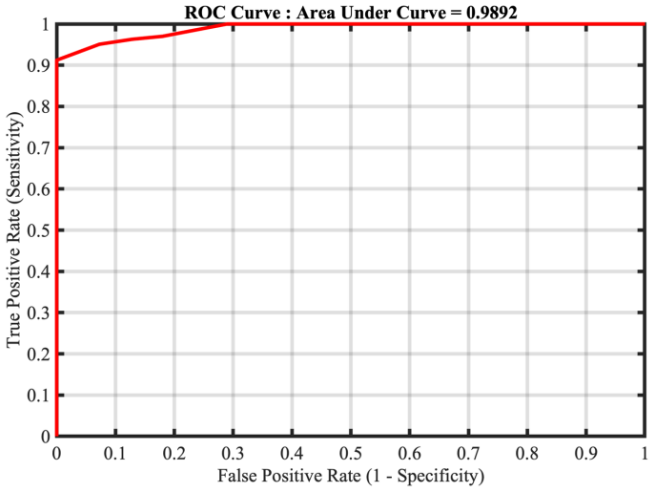

23
Motion Path

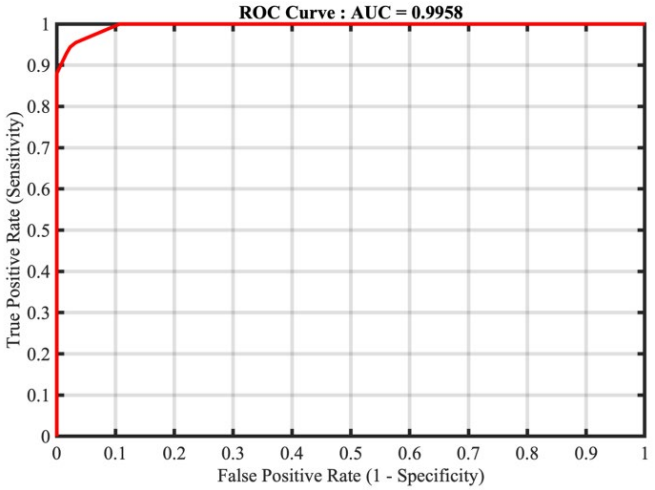
LA-UR-19-31191



TP	FP
FN	TN







Containers were damaged with denting, bulging, corrosion, and mock dis-charge residue. Damage was imposed with three levels of severity: level I (minor damage), level II(significant damage), and level III (catastrophic damage resulting in a containment breach). Level I targeted a level of damage that was just evident to the naked eye. An example of this is illustrated in Fig 27 (b,c,f). Minor note - the machine learning was not applied to corrosion results for a number of reasons.

Performance relative to Level I damage is probably the best way to address the question. We don't know what level of detection accuracy is "needed", but we can certainly aim to meet or exceed human performance. Better than the percentages you reference, I'd point you to Figures 29 and 30 (copy included herein). Reading across the top row of each:

A human inspector correctly identified 13 cases, miscategorized one (a trivial point), and altogether missed 7 cases.

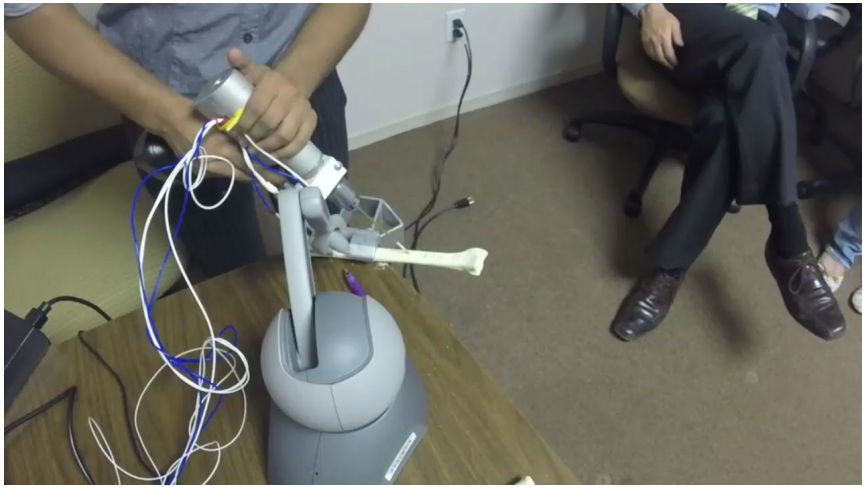
The AI / robotic system correctly classified them all.

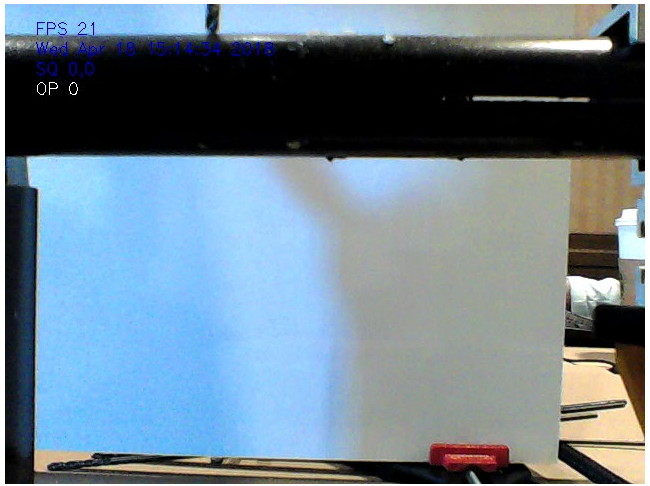
The results weren't as impressive with respect to Level II damage, oddly, with 3 false negatives .

Also results were mediocre with respect to residue false negatives (10) and false positives (4).

Thats said, even in these last two cases, those performance values were better than human.


FPS 55
Sat Apr 21 12:23:26 2018
SQ 0.80
OP 0

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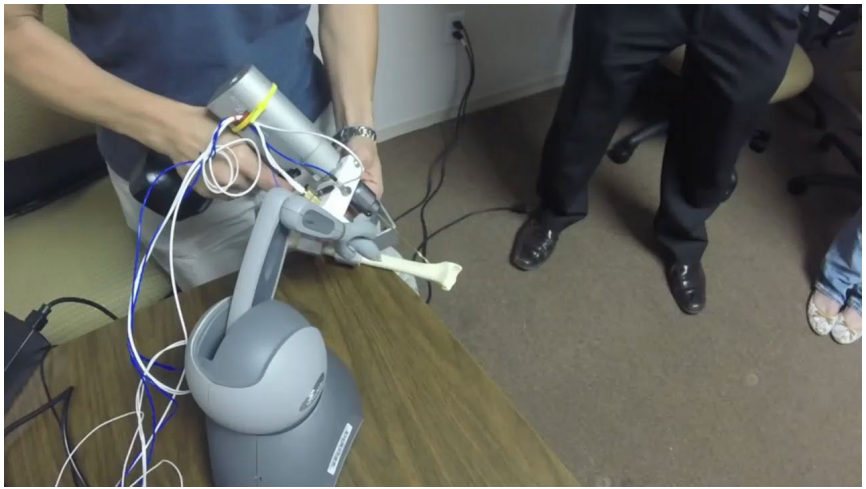
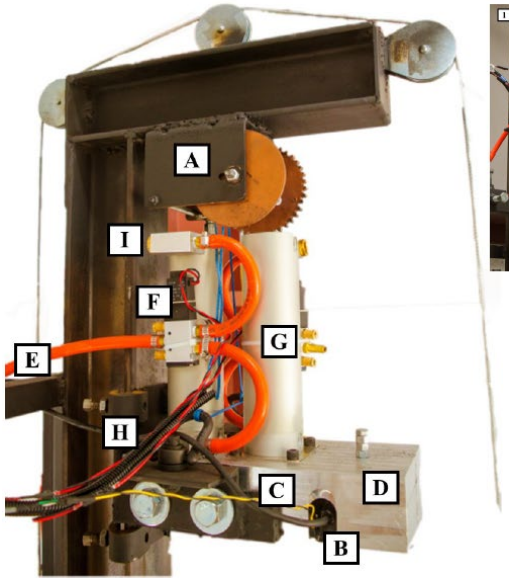
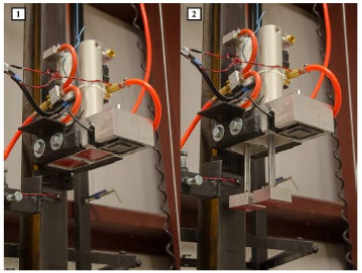
SQ 0.0
OP 0



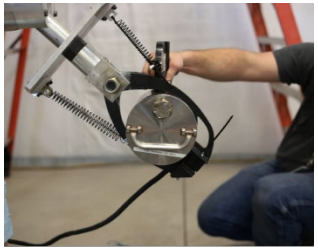


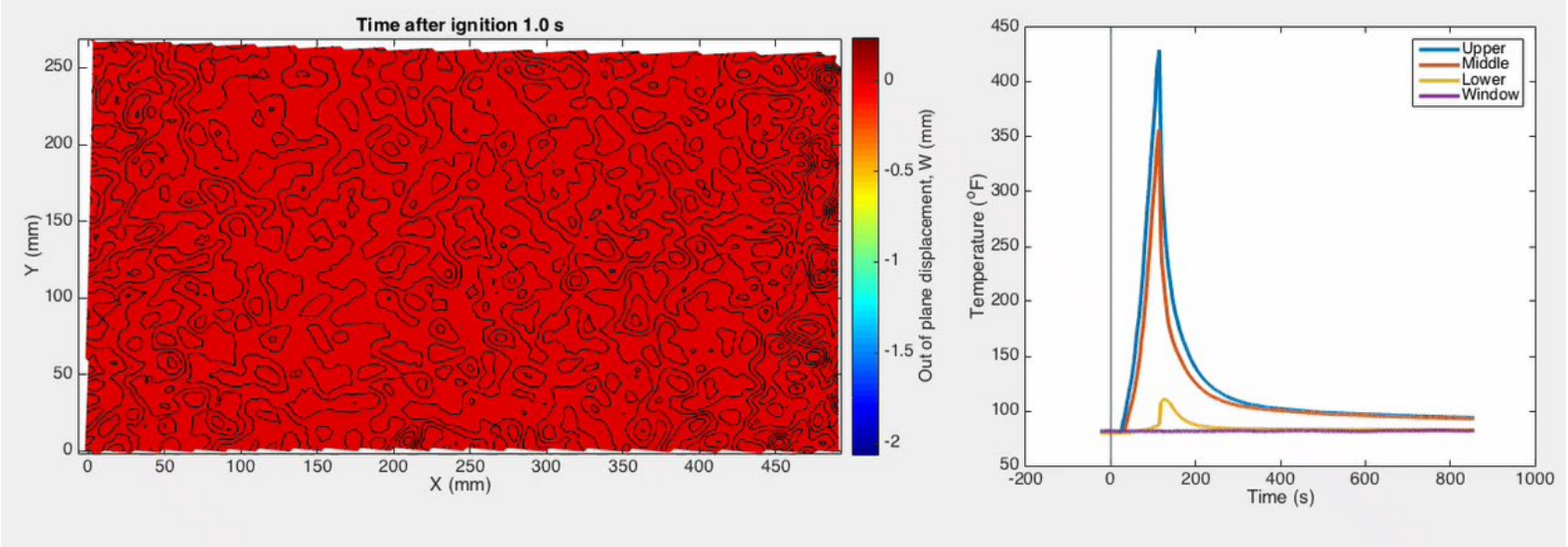


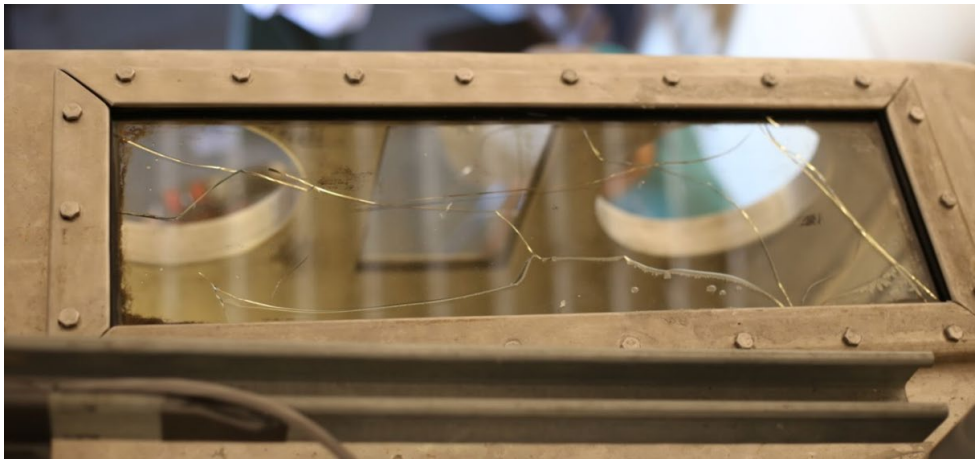
A: Dock winch
B: Electromagnet
C: Limit switch
D: Docking station
E: Air reservoir line
F: solenoid valve
G: Pneumatic solenoid
H: Locking clamps
I: Adjustable quick valve

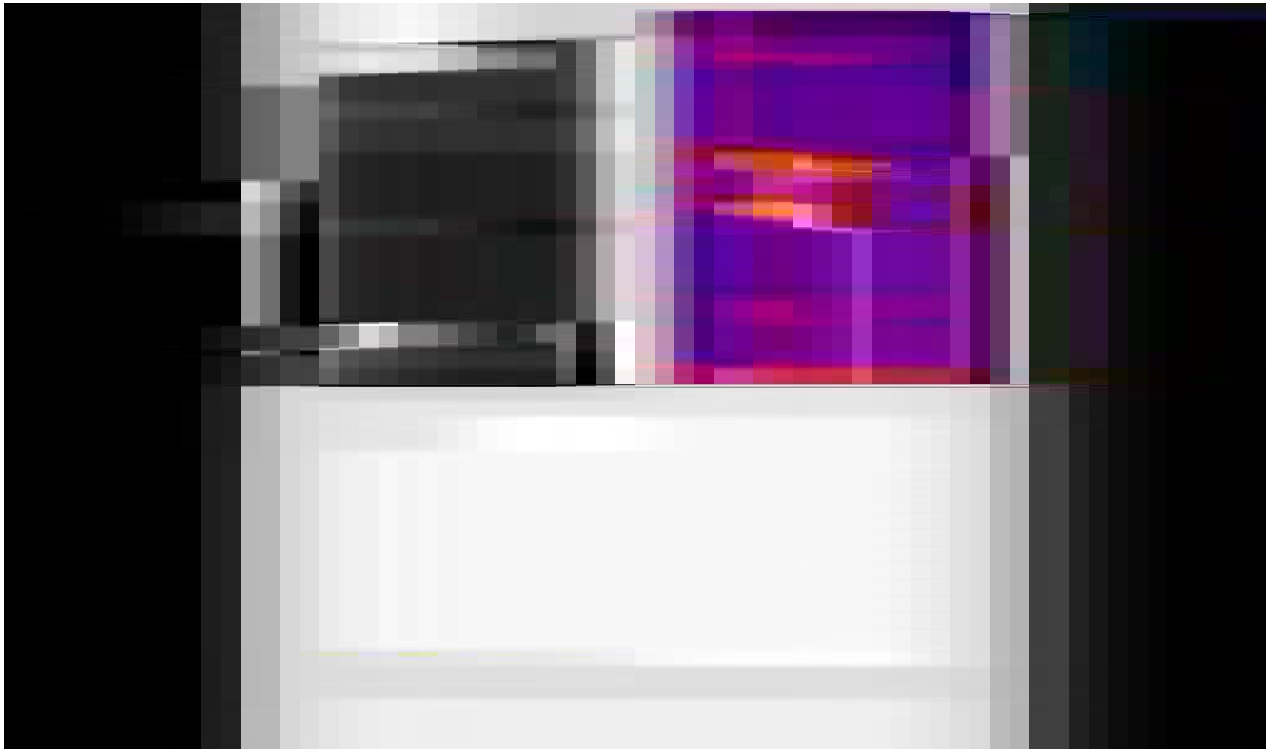
1: Pneumatic cylinders disengaged
2: Pneumatic cylinders triggered

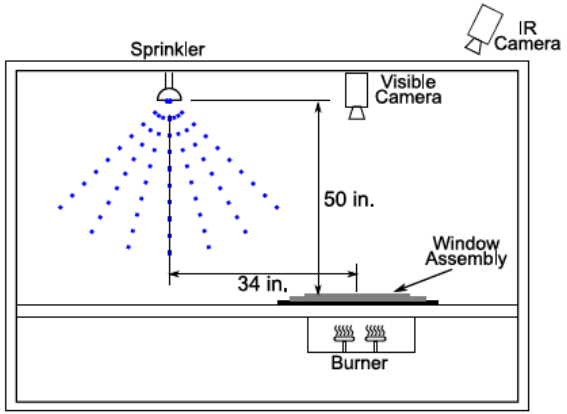
41



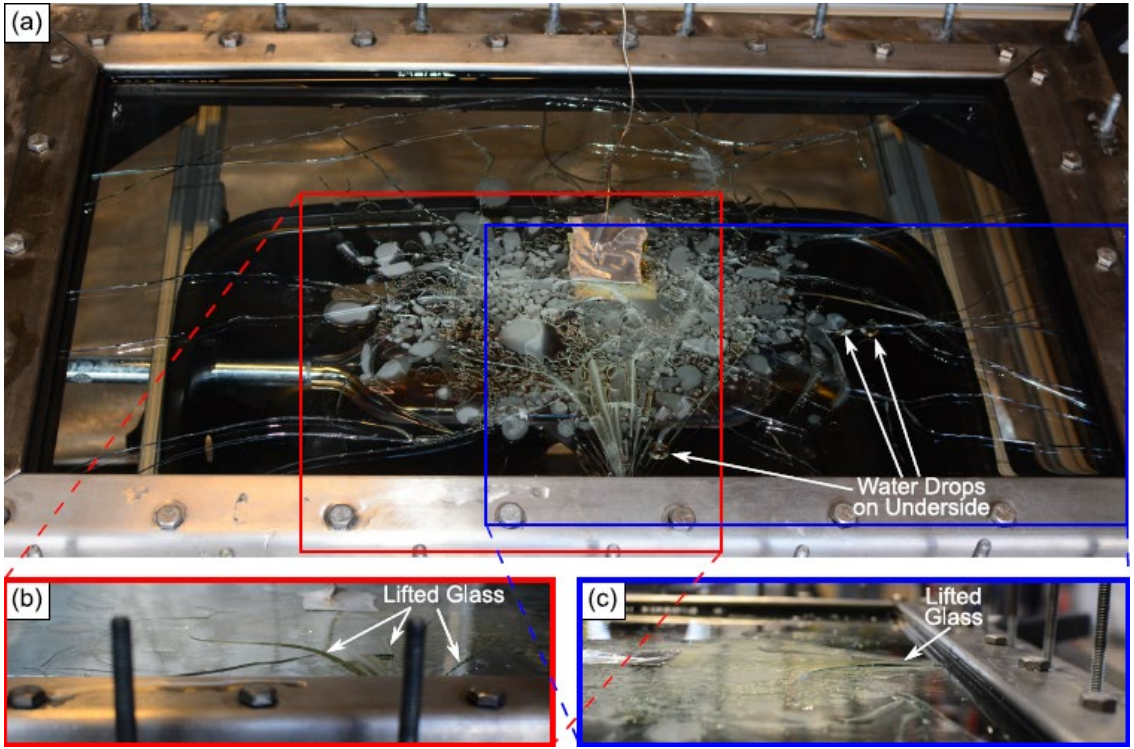

Time after ignition 1.0 s
Y (mm)
X (mm)
Out of plane displacement, W (mm)
0
-0.5
-1
-1.5
-2
Temperature (°F)
Time (s)
Upper
Middle
Lower
Window



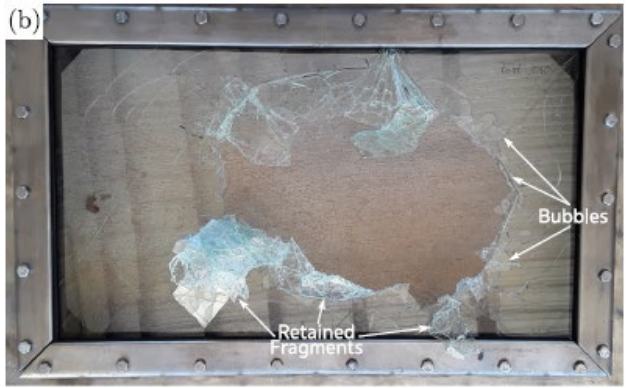



IR Camera
Sprinkler
Visible Camera
50 in.
Window Assembly
34 in.
Burner

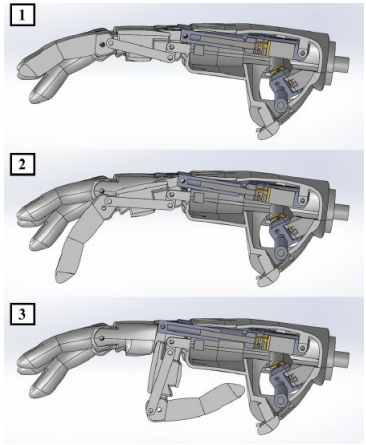

Window Assembly and Tank
Catch Basin
Support Frame

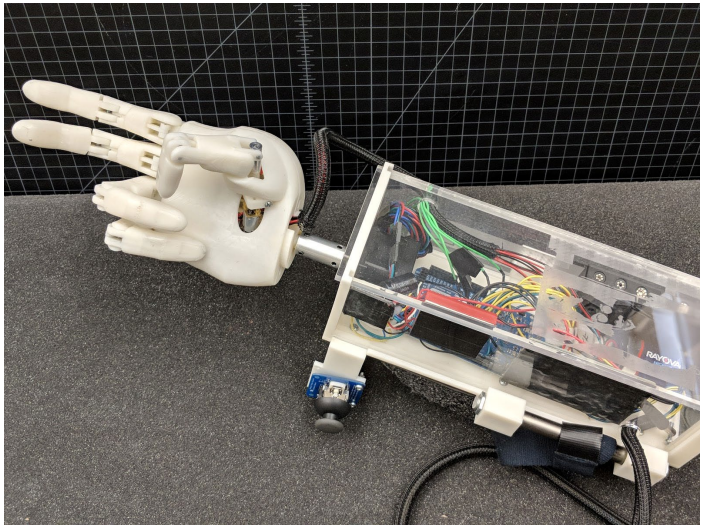

(a)
Water Drops
on Underside
(b)
Lifted Glass
(c)
Lifted
Glass


(a)

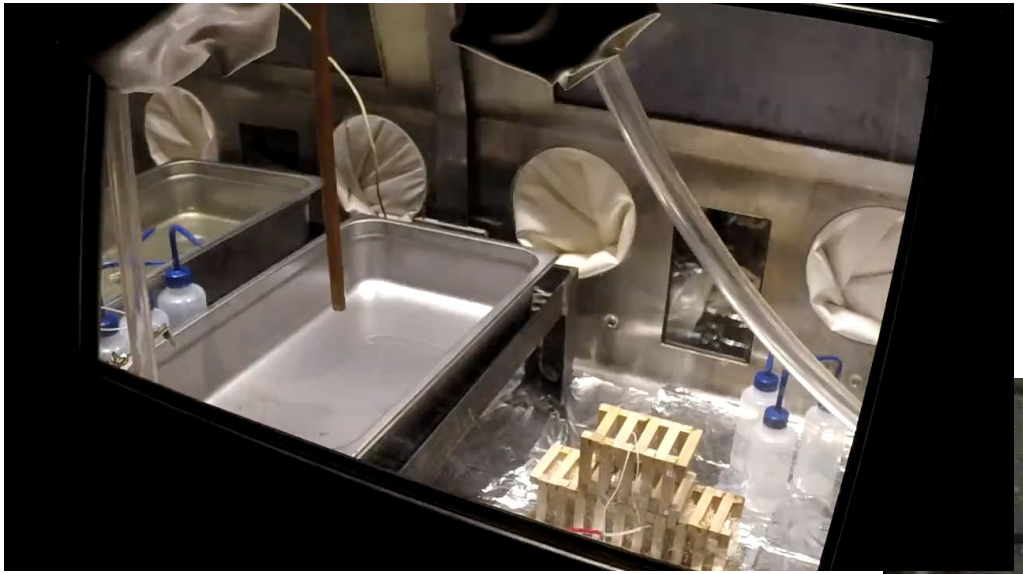

(b)
Bubbles
Retained
Fragments

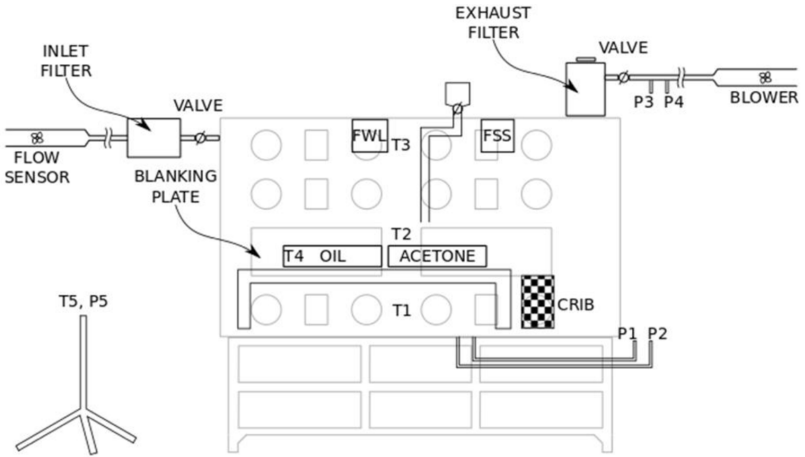
- end -


1
2
3




6.5 mm
10.6 mm
11.6 mm




EXHAUST
FILTER
VALVE
INLET
FILTER
VALVE
P3 P4
BLOWER
FLOW
SENSOR
BLANKING
PLATE
FWL
T3
FSS
T2
T4 OIL
ACETONE
T5, P5
T1
CRIB
P1 P2